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How new technology put a coelacanth among the heirs of Piltdown Man
correspondence

Nature 406, 343 (2000) Macmillan Publishers Ltd.

nature 27 July 2000

406 (n = 6794), p. 343

How new technology put a coelacanth
among the heirs of Piltdown Man

Sir - Biology has endured a long history of fakes, ranging from
Piltdown Man to feathered dinosaurs. Often meticulously crafted, these
frauds were not always easy to detect.

Fortunately, technology has provided an arsenal of forensic tools that
help reveal such fakery. But now digital imagery and powerful, simple-
to-use photo-editing software present a new opportunity for scientific
forgery. In the hands of a skilled user, this software can be used to
produce almost imperceptibly altered fake photographs¹.

Fortunately, the Séret, Pouyaud and Serre image² (purporting to show a
coelacanth captured in the Bay of Pangandaran off southern Java in
1995) does not fall into this category. It is clearly an altered copy of a
photograph of a live coelacanth taken by M.V.E. on 30 July 1998 off
Manado Tua and printed in Nature soon afterwards³.

While we would not be surprised if coelacanths turned up elsewhere in
Indonesian waters, Pangandaran does not seem to be a likely location.
Unlike the steep volcanic slopes of Manado Tua and the Comoro
Islands, where populations of coelacanths are known, Pangandaran is a
shallow, muddy bay.

Interviews with local Pangandaran fishermen and both the current and
the 1995 chief officers of the Pangandaran Fisheries Department, by
M.V.E. and scientists from the Indonesian Institute of Sciences,
revealed no evidence of past coelacanth catches and no familiarity with
the fish. Neither were the fishermen or fish vendors familiar with two
common 'indicator species' of potential coelacanth habitat: deep-water
snappers (*Etelis* spp.) or the oilfish (*Ruvettus pretiosus*).

This is not surprising, as the fisheries in the Pangandaran area consist
primarily of shallow, level-bottom trawlers and open-water pelagic
purse seines and longlines, with no evidence of the deep-water fishing
gear that typically results in coelacanth bycatches.

Much has been made of the nationalistic animosity that has tainted the
saga of the coelacanth. In our opinion, nationalism plays no role in
good science, and is irrelevant in chance discoveries such as that of the
Indonesian coelacanth. As scientists it is our responsibility to study and
conserve. The Indonesians and Comorans are rightfully proud of efforts
in their two countries to preserve these rare and very special fish. What

pride can we in the western scientific community take in this affair?

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http://www.nature.com/cgi-taf/DynaPage.taf?file=/nature/jou.../406343a0_r.html&filetype; 28/07/00

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How new technology put a coelacanth among the heirs of Piltdown Man

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1. Hayden, J. E. J. *Biocommunication* 27, 11-19 (2000).

2. McCabe, H. & Wright, J. *Nature* 406, 114 (2000).

3. Erdmann, M. V., Caldwell, R. L. & Moosa, M. K. *Nature* 395, 335 (1998).

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Recriminations and confusion over 'fake' coelacanth photo

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nature 20 July 2000

news

Nature 406, 225 (2000) © Macmillan Publishers Ltd.

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Recriminations and confusion over 'fake' coelacanth photo

HEATHER MCCABE

[PARIS] The hunt is on for the explanation of an apparently faked photograph of a coelacanth. The picture is alleged to be of the fish that French researchers say was discovered in Southwest Java in 1995-three years before the first official recording of such a 'living fossil' in Indonesia by US researchers (see *Nature* 406, 114; 2000).

Two authors of a recent submission to *Nature* describing the French discovery are claiming innocence and pointing the finger at the third, while admitting that even he may have been duped.

But he is also denying any wrong-doing. And the French Institut de Recherche pour le Développement (IRD), for whom all three have worked, has launched an investigation.

The submitted photograph appears to show a coelacanth lying next to three other fish typical of the region. But the image of the coelacanth is identical to a photograph taken by Mark Erdmann of the University of California at Berkeley (see *Nature* 395, 335; 1998).

One of the three authors of the French paper, Georges Serre, a former consultant for IRD's predecessor, ORSTROM, claims to have found the coelacanth in 1995. He says that the specimen he caught was lost on its way to the Indonesian fishery service, and that the photos he took of the fish were stolen.

The two other authors, Bernard Séret, an ichthyologist affiliated with the IRD, and Laurent Pouyaud, an IRD geneticist who works in Jakarta, both claim that Serre either doctored the photo or knew that it was a fake, although Pouyaud also accepts that Serre may have been "manipulated".

Séret sent the photo to an independent expert affiliated with the Tribunal de Paris who asserted that it was a forgery. But Serre - who has told Séret that the photo submitted to *Nature* was taken by a friend who has since died

wants a separate investigation.

said last week that he is not yet convinced that the photo is a fake and

Pouyaud also says that he has come across a preserved coelacanth in a private collection near Jakarta,

whose owner claims that the fish originated in Java. As it was roughly the same size as the coelacanth that Serre reportedly found, he concluded that it was the same fish.

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Dinosaurs of the Deep Discovered in South Africa

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Dinosaurs of the Deep Discovered

The most accessible Coelacanths in the world

In 1998, a discovery of a live coelacanth

off the island of Sulawesi in Indonesia

suggested that the species is more widespread than originally thought. It has now been shown by genetic studies that the Indonesian species is different from the Comoran species. The recent discovery off St Lucia is equally exciting, and suggests that the East London catch may not have been a stray, and that coelacanths could be widespread along the western Indian Ocean.

The preferred habitat of Coelacanth was thought to be on reef, at the edge of the continental shelves depths of between 200 and 600 m. The St Lucia discovery is the shallowest find so far, in the C zone of the sanctuary (multiple use zone) where diving and pelagic fishing is permitted, and the only population that can be accessed by divers. Coelacanths at the other sites can only be visited by submersible craft. Being at such a shallow site, the St Lucia fish are the most accessible Coelacanths in the world.

St Lucia also offers better diving and research support than any of the other

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opportunities for research and photography. Diving at depths in excess of 60m requires specialist training and the use of TRIMIX (a mixture of Oxygen, Nitrogen and Helium).

The department is looking at regulations that will bring the area under immediate control, by limiting all diving and research activity, until such time as we can develop a system of proper control and establish research rights.

Present activities in St Lucia and Maputaland will not be greatly affected by the emergency measure. Dive operators seldom take

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Dinosaurs of the Deep Discovered in South Africa

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Dinosaurs of the Deep Discovered
Incredible discovery off South Africa's coast
South Africa's Ministry of Environmental
Affairs and Tourism announced this
morning (1 December) that three live
coelacanths have been discovered by a
group of recreational divers. The amazing
discovery took place in the waters off the
coast of the Greater St Lucia Wetland
Park, which was declared a world heritage
site earlier this year.

The ancient and endangered fish, known
to scientists as *Latimeria chalumnae*, was
known to science only as 360-million-
year-old fossils, until the discovery of a
dead specimen in a fisherman's nets near
East London in 1939. Until now, the
species has been found alive in only two
countries: Comoros and Indonesia. This
new discovery took place in the St Lucia
Marine Protected Area, about 5 km (3
miles) north of Sodwana Bay and 800 m
(half a mile) from the shore.

South Africa's Environment Minister,
Mohammed Valli Moosa, said that this was
an exciting discovery which presented
major opportunities for research and
Subject Library tourism, and which added another
attraction to the Greater St Lucia Wetland
Park, which is South Africa's first World
All articles on this topic Heritage Site and the largest wetland in
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During a television interview earlier today, I was impressed by his calm insistence that he would not allow the site of the discovery to be turned into a "circus" or commercialized for short-term benefits. The minister stated clearly that dive charter companies would not be given licences to escort scuba-diving tourists to gawk at the ancient fish. Minister Moosa also declared an Emergency Measure, in terms of the Marine Living Resources Act, to protect the coelacanths.

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Media Statement: Coelacanths found in St Lucia Marine Area

Ministry of Environmental Affairs and Tourism

Media Statement

1 December 2000

Coelacanths found in St Lucia Marine Area

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Three live Coelacanths have been discovered in the St Lucia Marine Protected Area, just off the Greater St

Lucia Wetland Park, by a group of recreational divers, the Ministry of Environmental Affairs and Tourism

announced today.

Releasing photographs of these ancient and endangered fish, the Minister Mohammed Valli Moosa said

that this was an exciting discovery and presents major opportunities for research and tourism. This will add

another attraction to the Greater St Lucia Wetland Park, which is South Africa's first World Heritage Site and the largest wetland in the southern hemisphere. Thus far, the 360-million-year-old species has

been

found alive in only two countries: Comoros and Indonesia.

A group of recreational divers (Pieter Venter, Peter Smith, Dennis Harding, Peter Timm, Erna Smith, Etienne le Roux, Christo Serfontein and Martin Bench) discovered three living coelacanths at 107 m depth

on Monday 27 November 2000 in St Lucia Marine Protected Area, five km north of Sodwana and 800 m from the shore. The divers took approximately one minute of video footage of the fish. Dr Phil Heemstra of

the JLB Smith Institute of Ichthyology positively identified the species as a Coelacanth. Sadly, one of the

divers Dennis Harding died of a cerebral embolism, as a result of an uncontrolled ascent.

Given the international prominence of the 'living fossil', there will be great pressure by local and international dive operators and researchers to gain access to the site of the discovery, Minister Moosa has

declared an Emergency Measure, in terms of the Marine Living Resources Act (1998), to protect the living

Coelacanths found at St Lucia

Coelacanths are recognized as an endangered species and Minister Moosa said that urgent control is required to prevent disturbance of the fishes, reduce the likelihood of additional diver fatalities, ensure that

St Lucia Marine Protected Area benefits from the discovery, and secure research rights for South African

research organizations

JLB Smith described the initial discovery of a Coelacanth taken by a trawler near East London in 1938. Subsequent discoveries of live Coelacanths of the Comoro Islands suggested that the East London fish was a stray. It was feared that the group off the Comoros were an isolated relic, now endangered by scientific interest and collectors. IUCN have classified Coelacanths as vulnerable. The Comoran population

is estimated to be between 200 and 500 fish.

In 1998, a discovery of a live Coelacanth off the island of Sulawesi in Indonesia suggested that the species

is more widespread than originally thought. It has now been shown by genetic studies that the Indonesian

species is different from the Comoran species. The recent discovery off St Lucia is equally exciting, and suggests that the East London catch may not have been a stray, and that Coelacanths could be widespread along the western Indian Ocean

The preferred habitat of Coelacanth was thought to be on reef, at the edge of the continental shelves depths of between 200 and 600 m. The St Lucia discovery is the shallowest find so far, and the only population that can be accessed by divers. Coelacanths at the other sites can only be visited by submersible craft. Being at such a shallow site, the St Lucia fish are the most accessible Coelacanths in

the world. St Lucia also offers better diving and research support than any of the other sites.

Consequently,

there are great opportunities for research and photography. Diving at depths in excess of 60 m requires specialist training and the use of TRIMIX (a mixture of Oxygen, Nitrogen and Helium).

The department is looking at regulations that will bring the area under immediate control, by limiting all diving and research activity, until such time as we can develop a system of proper control and establish research rights. The discovery occurred in the C zone of the sanctuary (multiple use zone) where diving and pelagic fishing is permitted.

<http://www.environment.gov.za/speeches/2000/1dec2000.htm>

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Media Statement: Coelacanths found in St Lucia Marine Area

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Present activities in St Lucia and Maputaland will not be greatly affected by the emergency measure.

Dive

operators seldom take clients beyond 60 m depth, which is the limit for compressed air and NITROX diving.

Bottom fishing is already prohibited in the MPA.

Photographs (click on the photographs for larger images):

Coelacanth

Dennis Harding

Group photograph

Issued by the Ministry of Environmental Affairs and Tourism

1 December 2000

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The divers who discovered the coelacanths took approximately one minute of video footage of the fish. Dr Phil Heemstra of the JLB Smith Institute of Ichthyology positively identified the species as a coelacanth.

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The group of divers who made the incredible discovery:

Pieter Venter, Peter Smith, Dennis Harding, Peter Timm, Erna Smith, Etienne le Roux, Christo Serfontein and Martin Bench

Professor JLB Smith described the initial discovery of a coelacanth taken by a trawler near East London in 1938. Subsequent discoveries of live coelacanths of the Comoro Islands suggested

that the East London fish was a stray. It was feared that the Comoran population of coelacanths, estimated to be between 200 and 500 fish, were an isolated relic, endangered by scientific interest and collectors.

Next page > The most accessible coelacanths in the world

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Coelacanth in Danger

Going twice

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The ancient coelacanth, once thought to be long extinct, may be dying out for real, the unintended victim of fishermen

By Ellen Bartlett

CAPE TOWN, South Africa The island republic of the Comoros, in the western Indian Ocean, is known for its instability - political and seismic. It has 24 political parties, none in control. In 22 years of independence from France, there have been 17 coups or coup attempts. Two of the three islands in

the republic seceded recently and the government has been dissolved.

Mt. Karthala, on the island of Grande Comore, is one of the world's largest active volcanos, erupting every 20 years or so. Its last eruption was in 1975 and so it is overdue for another.

But in the deep ocean off the west shore of Grande Comoro, in the cool canyons and overhangs and crevices that slope steeply into darkness, is a living contradiction to the chaos above, a biological symbol of endurance.

The last of the coelacanths swims in the slow lane. Pale blue with iridescent white markings, reaching five feet in length, it is the last example of the crossopterygians, whose fleshy limb-like fins were the probable precursors of arms and legs. fishes. It is the end of the line that some scientists believe gave rise to the first tetrapods, or four-legged, land-dwelling vertebrates.

Assumed to have died out with the dinosaurs in the mass extinctions at the end of the Cretaceous period 65 million years ago, the coelacanth first resurfaced in 1938 in the net of a fishing trawler off East London, South Africa. It was the marine equivalent of stumbling across a living dinosaur.

But as the 60th anniversary of its discovery nears, the venerable fish is in danger of extinction, this time for real. The islands' fishermen are killing it off, though unintentionally.

The species was highly successful in its heyday about 400 million years ago - there are 125 species of coelacanth in the fossil record - but only one species is known to remain. *Latimeria chalumnae* exists in a single, tiny, relic population off Grande Comoro, at as far down as 2,000 feet.

Others have been caught, off South Africa, Mozambique and Madagascar, but they are believed to be strays from the Comoran group.

Marine biologist Hans Fricke and his colleagues from the Max Planck Institute in Germany have been following the Comoran coelacanths for 10 years, conducting surveys from a submersible vessel. They have identified more than 100 fish individually, and tagged more than a dozen.

Their early surveys, from 1987 to 1991, showed a stable population of as many as 650 fish. But by 1994, the number in their census area had dropped 30 percent. Then researchers also learned that the coelacanths' range was more limited than believed, pushing estimates lower.

In a paper to be published early next year in the journal "Conservation Biology," Fricke and colleague Karen Hissman estimate the population at less than 300 individuals, living along 38 miles of shore.

They warn that overfishing is reducing the population at such a rapid rate that the species is critically endangered.

"We think there is not very much time left to do something" to save them, Hissman said.

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Coelacanth in Danger

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If the last coelacanth species dies out, those who study it say, it will be one of the most tragic of modern extinctions.

"Here we have got one of the most significant back-boned animals that ever evolved, and it's going extinct. It could disappear within the next 15 to 20 years and there is no effective conservation measure in place," says marine biologist Mike Bruton of the Two Oceans Aquarium. With Fricke, Bruton is a leading authority on the coelacanth.

The killing is not purposeful. The coelacanth is dying out because it keeps getting caught by fishermen who don't even want it.

The target of the traditional fishing industry off Grande Comoro is *Ruvettus pretiosus*, the oilfish. The oilfish and the coelacanth share a deep water habitat close to shore, swim at the same depths, take the same bait. Until Western science alerted them to its value, Bruton says, fishermen regarded the coelacanth as a nuisance.

At best, it was let go. But because the coelacanth has impressive jaws and rows of small sharp teeth-and hooks are expensive - the more typical response was to beat it death and retrieve the hook before throwing back.

There was a flurry of local interest in the coelacanth after its discovery by scientists. JLB Smith, the

South African biologist who described the coelacanth in 1939, posted notices all over the islands, offering 100 pounds for a specimen. His efforts went unrewarded until 1952, when a second coelacanth was caught off the Cormoran island of Anjouan. There were no commercial flights to the islands, so Smith flew up in a South African military Dakota to claim the fish.

Coelacanths were caught in increasing numbers until the 1980s; most were sent to museums and aquaria for study. Scientists were concerned that even in the race to get specimens for research, they were endangering the species.

There was a drop in the number of coelacanths caught in the 1980s, a side effect of international efforts to help the impoverished Comorans develop their fishing industry. The European Community and the Japanese funded the construction of special floats, known as fish aggregation devices, to attract commercial fish species to new fishing grounds well offshore of the over-fished, close-in waters. Because the new fishing grounds were beyond the reach of the canoes, the group also paid for boats with outboard engines.

But the project ended. The engines broke down, and there was no one to fix them. The fishermen went back to their old dugouts, and back to fishing the inshore waters. They started hooking coelacanths again, and the population went on the sharp decline that continues today. Scientists also think that overfishing may slowly be robbing the coelacanths of their prey species, and high levels of insecticides have shown up in coelacanth tissue. The toxins are thought to have traveled via air from the African continent.

If the coelacanth disappears, it will do so leaving many questions unanswered, among them the fish's place in prehistory. Was it the coelacanth, with its primitive limb-like fins, or the lungfish, capable of breathing air as well as deriving oxygen from water, that is closer to the evolutionary line that led to amphibians, and thus to the rest of the tetrapods, including ourselves?

Those favoring the coelacanth argue that its blood hemoglobin is similar to that of tadpoles - though

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Coelacanth in Danger

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not to that of adult frogs. But tests of mitochondrial DNA indicate that the lungfish is our closer ancestor. Mitochondrial DNA, passed down through mothers and obtained from cell mitochondria, is used increasingly in determining relationships among ancient animals. Five species of the ancient lungfish also survive today, in Australia, South America, and tropical Africa.

Unlike the lungfish, which is little changed from its beginnings 460 million years ago, the coelacanth is not the window into the past that its finders had hoped it would be. The living coelacanth may look like its fossil predecessors, but it does not operate like them.

"The coelacanth is a highly specialized, extremely sophisticated animal, which almost certainly is not operating now the way it did 400 million years ago," Bruton says. "It is by no means ancient and primitive...It has found unique solutions to the problems that faced it."

The coelacanth borrowed from the cartilaginous fishes, like the shark, and the bony fishes, and remains somewhere between the two.

Like the shark, the coelacanth has a spiral valve in its intestine to increase surface area and enhance food absorption. Like the shark, it has a long cartilaginous tube instead of a backbone - what Bruton calls "a basic coathanger for everything to hang on." But it has a bony head, teeth and scales.

It is the only vertebrate with an intracranial joint, a feature once common among frogs, enabling it to raise its top jaw as it lowers its bottom jaw to increase its gape.

Perhaps most intriguingly, the coelacanth gives birth to live young, and did so long before the mammals came along. The females lay a number of eggs the size of oranges, which hatch in utero; the embryos consume their own yolk sac and then, some scientists think, their unhatched siblings. There is some evidence that they obtain nutrition and oxygen from their mothers.

But much remains a mystery.

"We don't even know where the juveniles live, we don't know how often they breed, we don't know

the growth rate, we don't know the gestation period," Bruton says.

Most of what coelacanths do is beyond human reach. By day they rest in lava caves. They hunt at night, moving down to depths a half mile or so, beyond the reach of the submersibles and the range of the transmitters on their tags.

Coelacanths operate like the big gliding birds of the air, riding the ocean currents and gyres, making slow circles back to their caves after a hunt. Contrary to popular belief, they do not use their flexible fins to walk on the ocean bottom.

They are the ultimate energy-saving species, making up for their poor ability to extract oxygen from the water with an extremely low metabolism. They move slowly, in a way that is almost balletic, Bruton says, "except when they ambush, and then they have a very fast acceleration."

The very aspects of their physiology that have served them so well through history are what are endangering them now.

No matter how seriously the Comoran fishing community take the scientists' warnings - and Hissman and others believe they do understand the coelacanth's precarious situation - the only way they can help save the fish is to not hook it in the first place.

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Coelacanth in Danger

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"A coelacanth pulled up through 21 atmospheres, from a depth of 200 meters [650 feet], is almost certainly not going to survive," Bruton says. "Firstly, in the hot surface waters of the Comoros, 26 degrees centigrade [79 degrees F.], there is so little oxygen that they'd probably asphyxiate. They're already oxygen-deprived from fighting the hook, and probably suffering from lactic acid overdose." Few that are caught alive remain alive for long. Bruton, with Fricke and Hissman in Germany, has proposed the construction of new floats to attract fish inshore but closer to the water's surface. This would enable fishermen to fish in safer waters, in their canoes, and reduce the chances of capturing coelacanths.

But, says Bruton, "It's very difficult to get money to conserve an animal that you can't see, and which tourists can't pay to go and look at.... People love conserving the hot and furries, but they don't like conserving the wet and slimies.

So Bruton and Fricke have come up with another plan to raise public awareness to the plight of the fish. They place a low-light video camera outside the entrance of one of the coelacanths' caves, and broadcast continuous, real-time video of their movements. The video would be shown on screens at an educational center on Grande Comore, and by satellite to the outside world.

Once again, the problem is money. And time is running out.

"The decline, plus the fact that they're highly specialized animals adapted to a narrow habitat range, suggests that they will become extinct," Bruton says. "Within a few more million years the coelacanth probably would have gone extinct anyway, but we are bringing it about within a hundred years of our finding it."

This story ran on page C01 (front of Science Monday section) of the Boston Globe on 1 December 1997.

Credit: Loren Coleman.

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THE FIRST DIVE

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567-4

DISCOVERY OF A VIABLE POPULATION OF COELACANTHS

(LATIMERIA CHALUMNAE SMITH, 1939) AT SODWANA BAY, SOUTH AFRICA

Pieter Venter, Peter Timm, Gilbert Gunn, Etienne le Roux, Christo Serfontein, Pieter Smith, Erna Smith, Mai

Dennis Harding and Phillip Heemstrah*

"Other scientists are more cautious, but I am optimistic that there is a coelacanth population on mainland, perhaps off central Mozambique, northern Natal or the Transkei. New submersible and renewed access will hopefully answer these intriguing questions in the near future."

Mike Bruton¹, March 1992.

On October 28th 2000, Pieter Venter, Peter Timm and Etienne le Roux were near the end of a minute initial exploratory dive to 104 m in the Jesser Canyon at Sodwana Bay, in the St Lucia on the north coast of South Africa (Fig. 1). As they were about to ascend, the first author (PV) pinkish eye reflecting the beam of his underwater light. He approached, and underneath an oval a fish about two metres long. After a few seconds he realised, much to his surprise, that the fish with its unusual lobed fins was a coelacanth. He summoned Peter Timm, and they saw two more coelacanths. Timm, who was concerned with their ascent, was unable to confirm the sighting. At the surface, Venter convinced him that these fish were coelacanths, and the divers then decided an expedition to do additional dives with a video camera to record the presence of this species. On November 27th a dive was planned to 115 m with a 15 minute bottom time; the divers were Pieter V.

Gunn and cameramen Christo Serfontein and Dennis Harding. The support divers were Pieter Smith, Martir

Etienne le Roux. After searching caves along the wall of the canyon for 12 minutes, three coelacanths were

filmed with the video camera (Figs 2 & 3) at a depth of 108 m. The largest fish was between 1.6 and 1.8 m

the other two coelacanths were about 1.5 and 1.0 m. The water temperatures at the bottom for the October

dives were 17 °C and 18 °C respectively.

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After 15 minutes, the divers started their ascent as planned, but at a depth of 70 to 60 m, some problem. Harding and Serfontein resulted in their uncontrolled ascent to the surface. Harding lost consciousness soon

and was rushed to the beach. Efforts to resuscitate him were unsuccessful. Serfontein was also unconscious

reached the surface, but with the assistance of Pieter Smith, he regained consciousness and was able to descend

immediately to a depth of 32 m to resume his decompression schedule. After 134 minutes in the sea, Serfontein

was rushed to the beach, administered oxygen and transported to Richards Bay for 6 hours of treatment in a decompression

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Figure 2. Adult *Latimeria chalumnae*, filmed at 108 m in Jesser Canyon at Sodwana Bay. The image was extracted from the videotape taken by Christo Serfontein.

Figure 3. Enlarged image of caudal fin and second dorsal fin of same fish shown in Figure 2, taken by Christo Serfontein.

DISCUSSION

The fossil record of coelacanths, comprising some 120 species arrayed in about 47 genera and three orders, extends from the Middle Devonian (380 million years ago) to the end of the Cretaceous (70 million years ago).

Coelacanths were thought to have died out, along with the dinosaurs and many other fossil groups. The first coelacanth was described in 1836, and the group is now well known in the literature on fossil fishes.

The genus *Coelacanthus* (meaning "hollow spine") refers to the hollow neural and haemal spines of the vertebrae that tubular pterygiophores supporting the dorsal and ventral caudal fin rays³. Three extinct species are known from African fossils, one in KwaZulu-Natal, one from the Free State, and one from Grahamstown. Most fossil coelacanths are known from marine deposits, but a few were adapted to freshwater. They attained their maximum diversity in the Triassic Period (some 200 million years ago), but disappeared from the fossil record at the end of the Cretaceous². Consequently, the zoological world was astounded when a living coelacanth (*Latimeria chalumnae*) was discovered off the Chalumna River near East London in December 1938.

Coelacanths have changed very little in the past 380 million years. The skeleton of *Macropoma mantelli*, which is known from the Upper Cretaceous, is identical to that of the living coelacanth and differs little from the skeleton of most Devonian coelacanths².

Marjorie Courtenay-Latimer's sketch of the coelacanth sent to JLB Smith upon the discovery of the origin of the coelacanth.

Although only a single specimen of *Latimeria chalumnae* has been caught off South Africa, the discovery of this first specimen did much to put South Africa and J.L.B. Smith on the ichthyological map of the world.

Thanks to the efforts of J.L.B. and Margaret Smith, Marjorie Courtenay-Latimer, French and more recently, Hans Fricke's observations and films of coelacanths in their natural habitat on Comoro, we have learned much about this fascinating fish.

Since 1952, when the "home" of the coelacanth was discovered, the zoological world has been fascinated by the discovery of a living coelacanth.

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coelacanth was discovered in the Comoros, more than 180 coelacanths have been caught with in depths of 35- 600 m on the steep volcanic slopes of Grand Comoro and Anjouan Island 8,9 coelacanth was trawled off the central coast of Mozambique 10 and a specimen was also caught net near Toliara on the southwest coast of Madagascar 11. The recently discovered coelacanth at the northern end of Sulawesi, Indonesia seem to be a separate species 12.

20 S
SOUTH
AFHIGA
Sodwanay
Durban,
East London
30°E
MOZAMBIQUE
Maputo
Pobang
40°E
Tollara
CONOROS
MADAGASCAR
50°E
30°S

Figure 1. Western Indian Ocean, showing sites for previous captures of *Latimeria chalumnae* and new discovery (black star) at Sodwana Bay, South Africa.

In May 1991, a project organised by Prof M.N. Bruton (then Director of the J.L.B. Smith Instit Ichthyology) brought Prof Hans Fricke and his submersible JAGO to South Africa to look for c and survey the faunal diversity in depths of 50-400 m along the coast of the Eastern Cape Pro dives totalling 23h 45 min were carried out at depths of 35-110 m in the Tsitsikamma Nationa Eastern Cape coast, and 8 dives totalling 23h 30 min were done to depths of 370 m on the co <http://www.world-stream.com/route/coelacanth/firstdive.htm>

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and slope off the Chalumna River Mouth. No coelacanths were sighted during the survey, no caves seen off the Chalumna River, as the friable sandstone terraces of the slope in this region being eroded too far.

conducive to formation of caves; in several places, the roofs of overhangs were seen to have The continental shelf off the coast of northern KwaZulu-Natal is narrow (approximately 3 km shelf break at -45 to -70 m, and along this coast there are some 13 canyons that begin at depths of -40 m within 1 or 2 km of shore and plunge to depths of -650 m within 8 km of shore.¹³ The beachrock/aeolianite walls of the Jesser Canyon where the Sodwana coelacanths were sighted more sturdy and suited to cave formation than the slope sedimentary rock off the Chalumna River sheltered habitat of this V-shaped canyon is also less exposed to the strong Agulhas Current relief slope off the Eastern Cape Province. The similar canyons along the coast of northern Kwa and Mozambique are also likely to be suitable habitat for coelacanths.

Because of the difficulty in sampling and observing fishes in rough bottom habitats below the fish fauna of these habitats is poorly known. This discovery of a small population of coelacanth at a depth of 104 m at Sodwana Bay, a popular dive site in South Africa, emphasises how little we know of life in the oceans and the need for further exploration and survey work to assess the fish diversity in southern Africa and the Western Indian Ocean.

The sighting of juvenile (1 m) and adult (1.6 to 1.8 m) coelacanths on two separate dives in population of *Latimeria chalumnae* in a marine protected area (St Lucia Marine Reserve), and news for the conservation of this apparently endangered species. The Minister of the Department Environmental Affairs and Tourism has acted swiftly to legislate for the protection of the population. A management plan is being prepared by the KwaZulu-Natal Nature Conservation Service in collaboration with the Marine and Coastal Management division of the Department of Environmental Affairs and Tourism. We express our condolences to family and friends of our fellow diver, Mr Dennis Harding. We thank Mr André Slade of Inner Space Developments, for the use of his underwater video equipment. Robin Stobbs, M. N. Bruton and Eric Anderson for their useful comments on the manuscript. Photographs of the coelacanths in this article are used courtesy of Pieter Venter and by Christo Serfontein. They may not be reproduced without their permission.

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